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PRESENTATION by V. L. HORTE to
CANADIAN PIPELINE CONTRACTORS ASSOCIATION
VANCOUVER, B. C.
-- APRIL 12th, 1973 --

There are so many aspects to Arctic Gas, and I tend to view each of them as being of such great importance, that whenever I have to talk about the subject, I face a dilemma. Much as I would like to, I cannot adequately cover all of these aspects in one address, and it is difficult to know which aspects I ought to confine my remarks to.

I am going to take the easy way out today, and talk about as many aspects as I can. I am going to talk about why we feel that a pipeline to transport natural gas from Alaska and the Mackenzie Delta is vital to Canada's interests, and about some of the construction problems which will be of particular interest to pipeline contractors. Finally, I intend to present just a few brief comments about suggestions which we have heard concerning the transportation of this northern gas by railway.

Canada is at the point in time at which we must start to look at sources other than just western Canada for our petroleum supplies, and I am thinking particularly of our natural gas supplies. The four provinces of western Canada are virtually our only supply source. And yet western Canada represents less than a quarter of the potential reserves which geologists believe are available for discovery and utilization.

If we are to be assured of adequate supplies to meet our requirements, we must

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soon start to tap the remaining 75 percent of our potential, which lies in the northern and offshore regions. Indeed, it is our belief that we must have the gas supplies of the mainland areas of the Yukon and Northwest Territories available to Canadian consumers by the end of this decade, if we are to maintain the assurance of adequate supplies which is so vital to our whole economy.

The problem is that there is no way in which this gas supply can be economically made available to Canadian consumers based solely on the Canadian market. At full compressor horsepower, the 48-inch diameter pipeline which we propose will be able to deliver in excess of four billion cubic feet per day, while the present demand for gas in Canada averages little more than three billion cubic feet per day. Northern gas cannot, obviously, pre-empt the entire Canadian market. And while Canadian demand for gas is increasing each year at a rate in the order of 250 million cubic feet per day, there is no way that this demand can be saved up; demand must be met as it arises, if not by natural gas, then by the next best alternative.

Only with the economies of scale which the U.S. market is capable of providing will it become economically feasible for Canadians to gain access to our gas resources in the north.

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It is not just the U.S. market which is vital to the Arctic Gas pipeline, however, but also the U.S. gas supply on the Alaskan North Slope. As presently envisioned, about half of the projected initial delivery of four bcf/d for the pipeline would be U.S. gas from Alaska, with the other half from

the Mackenzie Delta. Without this U.S. supply for the pipeline, it would be necessary, in order to provide the required throughput, to prove up twice the volume of reserves from the Canadian supply area, and a proportionately larger share of our potential northern gas resources would have to be committed to U.S. markets.

If North Slope gas were to become unavailable to this pipeline, the result would be a major setback in the development and utilization of our northern petroleum resources. Our access to these reserves could well be deferred for a long time, well beyond the point in time at which they would be required to help meet our gas market requirements.

This possibility does exist. As you know, El Paso Natural Gas is engaged in an extensive study of the feasibility of transporting North Slope gas by pipeline across Alaska to tidewater at the Pacific Coast where it could be liquefied for shipment by tanker to U.S. west coast ports. This would be a much more costly way for the United States to gain access to its Alaskan gas, and the supplies of northern gas which it would obtain would be diminished by virtue of the fact that Canadian gas surplus to Canadian needs would be excluded. But there is no doubt that the United States could use this alternative; and it would be hard pressed not to do so if a pipeline across Canada were to be delayed for an extended time.

In short, a pipeline to transport gas from the North Slope and the Mackenzie Delta is vital to Canada's interest, because it would provide the means for economic development and utilization of our large potential northern mainland

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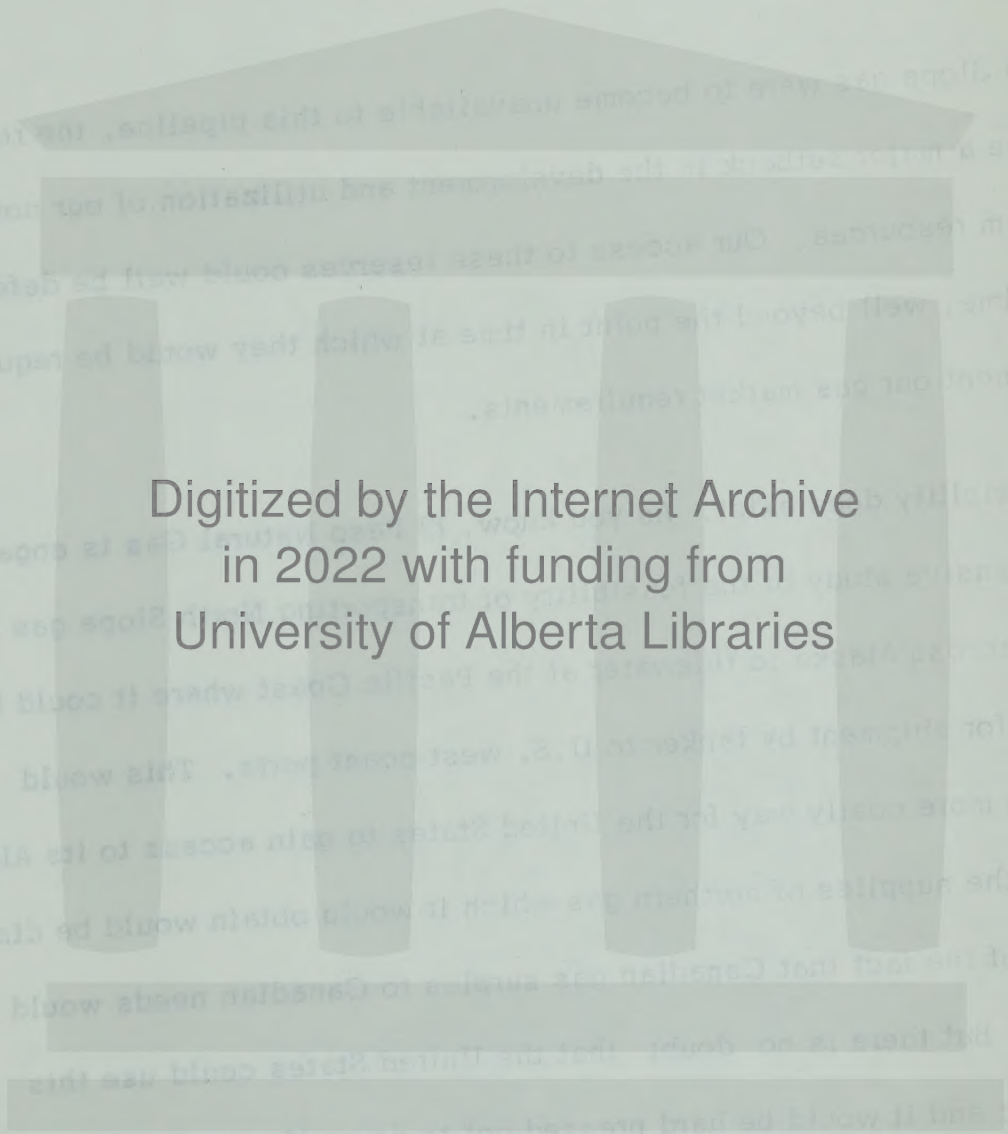

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gas resources. And the benefits of developing and utilizing this resource are many:

-- Assurance of adequate gas supplies for Canadian needs.

-- Generation of many hundreds of millions of dollars in government royalties through production royalty and lease payments, as well as large revenues from various forms of taxes.

-- Substantial revenue from the sale of this gas.

-- A dynamic and broad-based stimulation of the Canadian economy and national employment flowing from the activities involved in the development and utilization of this resource.

-- The generation of earnings to a great number of Canadian investors who we anticipate will be the majority owners of the pipeline.

There are 25 large firms participating in Arctic Gas, of which 10 are majority Canadian owned, and in four more of which there is substantial Canadian equity investment. We have to-date spent more than $30 million examining in detail the economic, engineering and environmental feasibility of the proposed pipeline. We intend to file with Canadian and U.S. government agencies as soon as we have obtained all of the information which we feel is required to properly support applications for approval to construct and operate the system. We hope to file applications this year.

An application for a certificate of public convenience and necessity will be filed with the National Energy Board, and we will file also with the Department of Indian Affairs and Northern Development to obtain use of federal lands for a right-of-way across the Yukon and Northwest Territories. We have

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been told that public hearings will be held before both the NEB and DIAND on these two applications. But we do not yet know whether this means a combined hearing before both bodies, or separate hearings before each body. And if there are separate hearings, we do not know how much duplication there will be on the subject matters and evidence to be considered by each body. In the United States, applications will have to be made to the Federal Power Commission and the Department of the Interior in respect to the facilities in Alaska, and the importation of gas into the United States. Arctic Gas itself will not apply for either export or import approvals, but these will, of course, have to be considered together with the facilities applications.

Preliminary feasibility studies of a pipeline to transport natural gas from the southern part of the Northwest Territories were started in 1967 by three of the present participants in Arctic Gas. Following the discovery of major reserves at Prudhoe Bay, the scope of the studies was expanded to include potential gas supply areas on the North Slope of Alaska and the Mackenzie Delta region in Canada. Three additional firms, holding the bulk of the gas reserves at Prudhoe Bay, joined the effort in 1970 to form the Northwest Project Study Group. At the same time, similar studies were undertaken by a six-member group headed by Alberta Gas Trunk Line Company, and known as the Gas Arctic Systems study group. The two groups combined their efforts in June, 1972 and the studies have been continued by Canadian Arctic Gas Study Limited and Alaskan Arctic Gas Study Company. There are now 25 companies participating in the Arctic Gas companies, of which 10 are majority Canadian-owned, and four have substantial Canadian investment.

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Depending on final route selection, the proposed pipeline, with full delivery capacity will embrace up to 3,000 miles of 48-inch diameter pipe, and in the order of two million horsepower at about 50 compressor and refrigeration stations.

Design operating pressure is 1,680 psi, requiring X70 pipe with a wall thickness of nearly three-quarters of an inch. At full capacity, the line will be able to handle a maximum gas supply of 4.5 billion cubic feet per day, with a delivery capacity in excess of four bcf/d, the difference being accounted for by line fuel. We presently anticipate drawing about half of this supply from the North Slope, and half from the Mackenzie Delta.

The unique design feature involves the refrigeration of the gas. Throughout the areas of permafrost, roughly north of 60 degrees latitude, the gas will be refrigerated at each compressor station to a temperature of about 25 degrees Fahrenheit, so that it will be close to the soil temperature, and below freezing. This chilled gas concept will allow the pipeline to be fully-buried along the entire length, and avoids the risk of any intolerable damage to high ice-content permafrost. The surface will be revegetated to provide a thermal insulation for the permafrost, and to arrest alluvial erosion. South of the permafrost area, the gas will be chilled to remove the heat of compression.

The right-of-way and compressor stations will occupy less that 40 square miles in the Yukon and Northwest Territories, out of an area of some 1.5 million square miles.

Alternative routes are still under consideration by Arctic Gas. In the north,

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the principal alternatives involve two optional routes from Prudhoe Bay across Alaska. One route lies east from Prudhoe along the coastal plain, then south up the Mackenzie River Valley. This route would cross the Alaska Wildlife Range. The alternative is to skirt the Wildlife Range by crossing the Brooks Mountains in Alaska and the Richardson Mountains in the Yukon. The coastal route is shorter, appreciably less costly, would traverse a greater area of potential gas supply, and we believe, would involve less risk of environmental impact.

South of the 60th parallel, the principal decision is whether or not to build a new pipeline as far as Emerson, on the Manitoba-North Dakota boundary, or to tie in with the existing facilities of Alberta Gas Trunk Line, TransCanada PipeLines and Alberta Natural Gas, which could be expanded to handle the increased volume.

Our studies are now seeking to determine the means of providing the most advantageous and economic transportation service.

The pipeline will be a contract carrier. We will neither buy nor sell gas, but will simply provide transportation for shippers of gas who contract for this service. It will be essentially a utility-type operation with a regulated rate of return.

The biggest unknown factor in timing will involve the time required to obtain government authorization. Allowing 18 months for this from the time of filing, the earliest that we could anticipate approvals would be during the first part of 1975. If we are lucky, this could provide for the assembly

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and delivery of materials during the summer, and start of construction during the winter of 1975-76.

Construction in the north would be limited to a winter season of about four months. Equipment would move over snow and ice roads to protect the vegetative mat which insulates the permafrost.

With careful planning it may be possible to build the northern end of the system as far as the Mackenzie Delta during two winter seasons, 1975-76, and 1976-77. The southern portion could be built during the summer and fall of 1976. This would permit the start of gas flow from the Mackenzie Delta by mid-1977, with the extension of the pipeline to the Alaskan North Slope gas during the following winter. This is an optimistic timetable. Factors beyond our control could obviously delay the starting time.

The pipe-laying will require nine to ten mainline construction spreads and two major river crossing crews. The construction spreads in northern Canada would have to complete 60 to 70 miles each during each winter season, and the prairie spreads would have to complete about 150 miles each during one fall and summer period.

The construction contract costs, excluding materials and based on unescalated 1972 costs, could amount to about $20 million per construction spread on the prairies, and $30 million to $50 million per spread for each season in northern Canada. The extension to Alaska, depending on route, will require

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eight to ten construction spreads for a winter season's work, and the contract cost per season is expected to be even higher than in northern Canada. The cost of construction equipment may amount to about $10 million per construction spread on the prairies, and in excess of $15 million for each northern spread. This means that you pipeline contractors will be looking at more than $150 million in equipment to handle this job. In addition to the pipe-laying, other construction work will include compressor stations, refrigeration stations, maintenance bases, camps, winter snow and ice roads, airports, docks, and stockpiling areas.

About eight of the compressor and refrigeration stations would have to be completed with the pipe-laying for the initial start-up of the line; the remaining compressor and refrigeration stations could be completed during the next couple of years to achieve full design capacity.

This construction schedule is dependent upon labour agreements which preclude the risk of work stoppages. Not only is the construction schedule dependent on this, but the entire economic viability could be seriously jeopardized by any extensive work stoppages.

Consider, for example, what the effects of a work stoppage would be at, say, the mid-way point of construction. By that time the investment would be about $2.5 billion. At nine percent interest, the carrying charge would be $225 million per year. This means that work stoppage at that point, in terms of interest on construction capital alone would cost more than $600,000 per day. At that rate, it is apparent that we could not tolerate the prospect of work

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stoppage, and suitable labour agreements will have to be achieved.

There is a precedent in the construction of the large Churchill Falls hydro-electric project, where the nature of the problem was basically the same, although on a smaller scale. In that case, labour agreements were obtained which essentially removed this risk element. We realize that attaining labour agreements of this nature would place considerable responsibility on the shoulders of the pipeline contractors, and for this reason we would be most pleased to work with you on this. We feel it is of importance to both the contractors, and to Arctic Gas.

In addition to its own technical staff, Arctic Gas employs some 30 consultants and research organizations on its wide range of study programs. These embrace aspects as diverse as metallurgy, soils mechanics, thermodynamics, transportation and logistics, sociology, economics and wildlife biology, to mention only some. It is difficult to imagine a research program involving a greater range of disciplines.

Principal study programs include: Pilot test pipelines at Sans Sault and Norman Wells, Northwest Territories, and Prudhoe Bay, Alaska. Chilled and compressed air, used to simulate the flow of natural gas, has been circulated through 5,000 feet of 48-inch diameter test pipes. In operation for nearly two years, these test facilities have demonstrated that fully-buried chilled gas pipelines can be constructed and operated without any permanent damage to the permafrost. This $7 million program has provided data on:

-- stability of gas pipelines in permafrost under various simulated operating

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-- stability of different types of foundations for above-ground structures;

-- effects of a pipeline on various forms of surface cover;

-- drainage problems associated with Arctic pipeline construction; and

-- construction methods, design techniques, material and equipment for use in an ultimate pipeline system.

Environmental studies, which cost $5 million by the end of 1972, included both wildlife and vegetative studies in northern Canada and Alaska.

The wildlife studies are defining any possible areas where construction and operation of the pipeline might conflict with the wildlife resources, and means to avoid or minimize such conflict. The vegetation studies are showing us how to restore a vegetation cover over a buried pipeline in order to minimize thermal erosion of the underlying permafrost in the vicinity of the pipeline, and to arrest alluvial erosion.

Base line studies completed to the end of 1972 have provided an immense amount of valuable information on the habitat, populations and characteristics of wildlife resources through a large segment of the north. Several million dollars more are being spent on environmental studies which now zero in on specific impact areas.

They will, for example, show such factors as the timing and location required for river crossing to avoid disturbance of fish; other critical periods and locations where construction activity may have to be restricted to avoid disturbance to caribou when they are calving, or migratory birds during their brief pre-migration feeding period on the Arctic coastal plain.

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Some of the other areas of study underway by Arctic Gas include:

-- Transportation alternatives, to provide an assessment of the engineering, economic and environmental factors involved in alternative modes and routes for transporting natural gas.

-- Economic studies, to assess the impact of financing and operation of the pipeline on the Canadian economy including such aspects as as employment, balance of payments, foreign exchange rates and interest rates.

-- Financing studies. Our objective is a viable plan of financing which will provide first priority to Canadian investors and a minimum 51 percent Canadian equity ownership. The only limitation on Canadian ownership that we can foresee will be the amount of funds that Canadian corporate, institutional and private investors choose to make available.

-- Regional socio-economic impact of the pipeline in the Northwest Territories and Yukon.

-- Recruitment, training and employment of northern residents for construction and operation of the pipeline. A program employing northern residents on training programs on the operating facilities of Alberta Gas Trunk Line has been underway for Arctic Gas in Alberta for more than two years. Results have been most encouraging. Successful trainees are offered permanent employment with Alberta Gas Trunk Line, and will have an opportunity to work on the operation of the proposed northern pipeline.

We are working with other companies in the petroleum industry to develop

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more comprehensive training programs which would embrace not only pipeline operation, but exploration, drilling, producing and gas processing plant operations in the north.

Finally, I would like to comment briefly on suggestions concerning the possible use of railways for the transportation of this northern gas.

The first point to be made perfectly clear is that a pipeline is not the primary objective of the 25 member firms of Arctic Gas. The real objective is to provide transportation for this Arctic gas to Canadian and U.S. markets by the most economic, reliable and safest means possible, with minimal impact on the natural environment. You need only to consider the interests of our member firms -- which include potential gas producers, gas buyers, and Canada's two major railways -- to appreciate that this must be our objective.

The studies which we have underway do include examination of alternative modes of transportation, and we believe that these will conclusively demonstrate the optimum mode.

Having said this, we have no doubt in our minds that when the alternatives are examined in detail at the public hearings which will follow our applications to government bodies, the pipeline will be seen by everyone as clearly as it now seems to us, to be that optimum transportation mode.

Delivery cost is one major reason why we find it most difficult to view a railway as a viable alternative for the transportation of this gas.

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To move by rail, the gas would have to be liquefied in the field at Prudhoe Bay and in the Mackenzie Delta, and re-gasified at the point of transfer from rail to pipeline, near the southern boundary of the Northwest Territories. Our preliminary calculations suggest that the cost of this liquefaction and gasification will be in the order of 45 cents to 55 cents per thousand cubic feet. The cost of movement by railway would be in addition to that. This compares with approximately 40 cents per mcf which we presently estimate will be the average cost of pipeline transmission from the Mackenzie Delta and Prudhoe Bay areas to about the Alberta-Northwest Territories boundary. In other words, the entire cost of building and operating the railroad will be basically an extra cost, over and above the total pipeline cost.

A further disadvantage to rail movement is the fact that the gas consumed in the liquefaction process is at least three times that used as fuel for pipeline transportation across Alaska, the northern Yukon and the Northwest Territories. In light of current energy needs, this is a very significant factor.

I do not intend in this discussion to explore in detail the environmental considerations relating to a railway versus pipeline. There can be no doubt, however, that the environmental impact of a fully-buried natural gas pipeline would be far less than the environmental impact of a railway.

One great advantage claimed for the railway is employment creation, with an estimated 4,500 jobs involved in operating the railway. But this benefit may lie more in appearance than in reality.

It is true that the operation of a pipeline would directly employ far fewer

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people than the operation of a railway. But given even the pipeline and the indirect employment that would result in exploration, drilling, operation of the gas wells and gas processing plants, and the provision of goods and services, the result will be the creation of long-term jobs in the north which will substantially exceed the available labour force of the north.

The real employment challenge in the north will not be the simple creation of jobs, but the provision of adequate training and other measures to ensure that northern residents will be able to take advantage of the available job opportunities.

I do not want to leave the impression that there may be no validity for a northern Canada railway. I simply stress that it could have no economic validity for the transportation of natural gas.

I started, gentlemen, by observing that I tend to view every aspect of Arctic Gas as being of vital importance. What I hope that I have been able to indicate is that every aspect of Arctic Gas is of vital importance to Canada.

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